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SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS.—United States and Canada \$3.50 a year.
Great Britain and Europe..... 4.50 a year.

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HOW MANY ARCHÆAN ROCK-GROUPS HAVE WE IN GREAT BRITAIN?

BY CH. CALLAWAY, D.SC., M.A., F.G.S., WELLINGTON, SHROPSHIRE, ENGLAND.

RECENT geological research amongst the pre-Cambrian rocks of North America, while it has settled some points, has unsettled others. A generation ago the terms "Laurentian" and "Huronian" were thought to have a clear and definite application. At that time, we in Great Britain knew of only one Archæan group, called Hebridean or Lewisian, and supposed to be the equivalent in time of the Laurentian. Later on, British geologists discovered a second pre-Cambrian formation, the "Pebidian" of Dr. Hicks, or "Uriconian" of the writer. This great volcanic system bore many resemblances to the published descriptions of the Huronian, and it was referred with more or less hesitation to that group. Meanwhile, Dr. Sterry Hunt was creating more systems in America. We heard of his "Norian," "Moutalbian," "Taconian," and "Keweenawian," and every year we looked for new worlds from his prolific brain. Unfortunately, subsequent research in the United States and Canada has but very partially confirmed Dr. Hunt's results, and even our faith in "Laurentian" and "Huronian" has been somewhat confused. "Huronian" appears to be several things, and "Laurentian" in some localities is said to be an intrusive granite. Nevertheless, it appears to be generally admitted that in North America there are gneisses and granites which are older than any other rock-masses, and that in the same region there are volcanic formations which are younger than these crystallines, and more ancient than the Cambrian; so that the old notions on "Laurentian" and "Huronian" remain true in a general way. It would also seem that North America contains sedimentary rocks which are newer than the Huronian, and are yet pre-Cambrian. Thus it would hardly be rash to conclude that, on the western side of the Atlantic, there exist at least three Archæan rock-groups, a gneissic, a volcanic, and a sedimentary, and that they succeed each other in the order here given. Now it is interesting to remark that this description agrees with the latest results of research in Great Britain. We have first of all the gneisses and schists, which in Scotland are called "Hebridean," and "Malvernian" in England. We cannot say that these formations are the exact equivalents of each other, and it would certainly be rash to assert that they, or either of them, can be correlated with any rock-masses the other side of the Atlantic. Nevertheless, they are admitted to be the oldest rocks in Britain, and, in the opinion of the writer, they are separated by a considerable interval from the formation which comes next. This great volcanic system holds the place originally assigned to it in the Archæan series by Dr. Hicks and the writer. Its pre-Cambrian age has been admitted by Sir A. Geikie, director-general of the Geological Survey of Great Britain and Ireland, so far

as the Uriconian rocks of Shropshire are concerned; but he assigns the Pebidian of St. Davids to the base of the Cambrian. In the opinion of the writer, the volcanic rocks of St. David's are truly pre-Cambrian; so that the name "Pebidian," originally given to them by Dr. Hicks, has priority over the more modern term "Uriconian." These rocks are of wide distribution, being found in North and South Wales, at Charnwood, near Leicester, in many parts of Shropshire, in the Malvern Hills, and probably at Howth, near Dublin. Evidence has recently been collected of a third pre-Cambrian system. Near Church Stretton, in Shropshire, is a chain of hills, forming Longmynd, built up of conglomerates, sandstones, and slates. Murchison called these sediments "Bottom Rocks," and he referred them to the Lower Cambrian. This view has been adopted by the English Geological Survey, and generally accepted. Recently, however, evidence has been collected which makes it almost certain that this formation is of pre-Cambrian age, and the present writer has given it the name "Longmyndian." The true basal Cambrian, a band of quartzite, occurs in close proximity to the Longmynd rocks, though not in absolute contact; and it is incredible that the Longmyndian, which is some miles in vertical thickness, should be a mere subdivision of the Cambrian, which is found in three of its four members within a few miles to the east. It would seem, then, that on both sides of the Atlantic, the Archæan (or pre-Cambrian) series consists of (at least) three members, gneissic, volcanic, and sedimentary, which follow each other in the same order, suggesting a similarity of conditions in both areas in the successive epochs of Archæan time.

LETTERS TO THE EDITOR.

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Is the Maya Hieroglyphic Writing Phonetic?

In No. 505 of the *Science*, Professor Cyrus Thomas devotes a few more pages to the problem of the Maya hieroglyphic writing. "These," he says, "may perhaps be profitable to the subject, if confined to an earnest endeavor to arrive at the truth." The "additional evidence," introduced in this manner by Professor Cyrus Thomas, he has seen fit to precede by some remarks intended to invalidate the criticism I offered in this paper some months ago (*Science*, Aug. 26). My answer to these remarks is presented in the following lines, which, I trust, will also be profitable to the subject, although I do not claim to be the only scientific man that "earnestly endeavors to arrive at the truth."

Professor Thomas is correct in stating that "a dot and two crosses with a month-symbol form a date in the bottom line of Plate 49, Dresden Codex." Nevertheless, I firmly believe I can maintain that "there does not exist a numeral designation with crosses between the dots." I have never seen it in the Codices. On the other hand, I found, for instance, on the sides of the Stela J of Copan (Maadsley, "Biologia Centrali Americani," Pl. 69-70) that the *one* dot of the numerals 1, 6, 11, and 16 always is framed by two ornamental signs, but there is never an ornamental sign between the *two* dots of the numbers 2, 7, and 12. Compare the Figs. 1-16 of the adjoined table. Moreover, I think, the analogy between the two hieroglyphs, Figs. 29 and 30 (of my former paper), is obvious. Since in the one case the two dots and the cross are a part of the hieroglyph and not a numeral, I hope, it will not be a fault of veracity to believe the same in the other.

Professor Thomas says I am not correct in stating that Fig. 30 (of my former paper) is the glyph he interpreted "moisture." "True, the parts are similar," he says, "but the details and surroundings are different." In the adjoined table I reproduce the Fig. 30 of my former paper by Fig. 17, and Professor Thomas's moisture symbol by the Fig. 18. Certainly, the surroundings are different. In Fig. 17 the hieroglyph is placed on a dish, in Fig. 18 on the hand. And there are wanting in Fig. 18 the two dots and the cross that are seen in Fig. 17. But the parts are not